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**FEDERAL COMMUNICATIONS COMMISSION
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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
)	
Revision of the Commission Rules)	CC Docket No. 94-102
To Ensure Compatibility with)	RM-8143
Enhanced 911 Emergency)	
Calling Systems)	
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To: The Wireless Telecommunications Bureau

SPRINT PCS COMMENTS AND WAIVER REQUEST

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Summary of Sprint PCS Comments and Waiver Request

This proceeding addresses 911 access to emergency safety agencies, or “PSAPs,” by persons with hearing or speech impairments when using text telephones (“TTYs”). Providing universal 911 access is important to the wireless industry. But 911 access is only a small subset of a broader issue: how persons with hearing and speech impairments can take advantage of advanced digital telecommunications capabilities and services like Sprint PCS’s state-of-the-art CDMA wireless network, or the third-generation technologies CDMA carriers will begin deploying in the next few years.

While Sprint PCS believes that it already is in compliance with Rule 20.18(c), it seeks a waiver in the event the Wireless Bureau determines that a waiver is necessary. There is good cause of entry of a waiver. As a carrier, Sprint PCS is dependent on handset and network equipment vendors to develop TTY compatible solutions, and to date these vendors have been unable to build a solution that consistently meets the error rate levels achieved on first-generation analog systems.

Although the root cause of the obstacle faced by the CDMA industry was first identified only months ago, possible solutions are already appearing on the horizon. For example, one CDMA vendor announced just last month the discovery of an apparent solution that will reliably transmit TTY calls over CDMA networks. Preliminary simulation tests results are promising, and if confirmed by subsequent testing, vendors should be able to manufacture TTY-compatible CDMA handsets that TTY users can use in accessing advanced CDMA networks.

In addition, Sprint PCS has begun to deploy a mobile data network. This deployment offers new opportunities for all Americans, including persons with hearing or speech- impairments, because the network will enable our customers to enjoy e-mail and file transfer access to the tens of millions of personal and host computers connected to the Internet while they are away from home or work.

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SPRINT PCS COMMENTS AND REQUEST FOR WAIVER

Sprint Spectrum, L.P., d/b/a Sprint PCS ("Sprint PCS"), pursuant to Commission Rule 1.3 and in response to the Wireless Telecommunications Bureau's November 13, 1998 Order,¹ seeks a waiver of Rule 20.18(c) if the Bureau determines that the rule waiver is necessary. Sprint PCS also updates the Bureau on recent developments regarding access to advanced digital telecommunications networks by users of analog text telephones ("TTYs") and other persons with hearing or speech impairments.

I. 911 Access Is a Subset of a Broader Issue: Ensuring that Persons with Hearing or Speech Impairments Have Full Access to Advanced Telecommunications Networks

Universal access to 911 emergency services is important to all Americans. 911 access by persons with hearing or speech impairments using TTYs is available today from cellular and dual-mode PCS handsets. TTY 911 access is also available over digital CMRS net-

¹ See *Revision of the Commission's Rules to Ensure Compatibility with E911 Emergency Calling Systems*, CC Docket No. 95-102, DA-2323 (Nov. 13, 1998) ("November 13 Order").

works, although at times these transmissions include error rate levels that can be unacceptably high, especially in a time of an emergency.² Sprint PCS discusses in Part III below promising new vendor developments that should enable TTY users to access advanced CDMA networks for all their mobile telecommunications needs (including 911 access) — without the error rate levels encountered with current arrangements.

In Sprint PCS's judgment, however, the real issue is ensuring that persons with hearing and speech impairments have full access to advantaged digital telecommunications networks, whether the new second-generation CDMA networks or the third-generation technologies CMRS providers will be introducing in the near future. As discussed in Part IV, Sprint PCS is now in the process of deploying a new mobile data network that will offer new opportunities for all Americans while they travel, a mobile communications capability that should be particularly attractive to persons with hearing or speech impairments.

II. There Is Good Cause for Entry of a Waiver of Rule 20.18(c) If the Bureau Determines That a Waiver Is Necessary

Rule 20.18(c) provides that CMRS licensees “must be capable of transmitting 911 calls from individuals with speech or hearing disabilities through means other than mobile radio handsets, e.g., through the use of Text Telephone Devices (TTY).” While Sprint PCS believes that it is now in compliance with this Rule, it seeks a rule waiver if the Bureau determines that a waiver is necessary.

Many Sprint PCS customers use dual-mode handsets. For some customers (including those for whom 911 access is paramount), dual-mode handsets are deemed important because cellular carriers, with their 10-year head start, have much larger coverage areas than new

² One of the baffling issues about this subject is that the error rate levels are minimal on some

entrant PCS licensees. TTY analog Baudot tones are capable of working over analog cellular networks; indeed, a recent study by Gallaudet University “demonstrated that the TTY calls sent using the analog mode of the dual-mode handset were relatively clear.”³ Thus, Sprint PCS provides a mobile service that enables TTY users to originate telecommunications, including calls to 911 emergency centers.

Sprint PCS is also capable of transmitting 911 calls from TTY users that connect to current CDMA handsets.⁴ While Rule 20.18(c) does not specify the standards by which CMRS providers must transmit 911 calls, current arrangements sometimes result in error rate levels that are less than desirable, especially in times of an emergency. It is not surprising that difficulties have been encountered when one connects an analog TTY utilizing 19th century technologies with 21st century digital technologies like CDMA networks.⁵ However, Part III documents promising new developments that may soon resolve this obstacle.

TTY/CDMA calls, while on other TTY/CDMA calls the error rate levels can be substantial.

³ April 1998 TTY Forum Status Report, at 9 (April 10, 1998).

⁴ Sprint PCS must respectfully disagree with the Bureau’s statement that “users of TTY devices will not be able to operate such devices in conjunction with digital phones at any time in the near future.” *November 13 Order* at 3 ¶ 7. In fact, TTY telecommunications can be transmitted over digital CMRS networks today, *albeit* not with a consistent quality level that is important in times of an emergency.

⁵ TTYs are based on the Baudot protocol developed by Emile Baudot in 1880. *See E911 Order*, 11 FCC Rcd 18676, 18701 n.77 (1996). The Baudot protocol was used with the original telex or teletype machines introduced in the early 1900s, but it has not been extensively used since then. This protocol is incompatible with the ASCII protocol used by most people and in most industries. *See, e.g., Telecommunications Services for Individuals with Hearing and Speech Disabilities*, 6 FCC Rcd 4657, 4661 n.21 (1991); *Amateur Radio Service*, 68 F.C.C.2d 1290, 1291 ¶ 5 (1978). Indeed, some years back the Commission was “persuaded that a phase-out period for Baudot would be in the public interest since ASCII is, by all accounts, a superior technology.” *Telecommunications Services for Individuals with Hearing and Speech Disabilities*, 6 FCC Rcd 4657, 4661 ¶ 20 (1991). *See also Access to Telecommunications Equipment and Services for the Hearing Impaired*, 3 FCC Rcd 1982, 1988 ¶ 52 (1988) (“[I]f the TDD users were to migrate to the more common ASCII terminal they would be able to communicate with millions of such terminals in residents and businesses.”).

If, however, the Bureau determines that Sprint PCS is not in compliance with Rule 20.18(c), then Sprint PCS seeks a waiver. The Commission has made clear that a CMRS licensee's obligation to serve, including the transmission of 911 calls, extends only to those persons that use "mobile equipment that is technically compatible with the licensee's base stations."⁶ To date, TTY and CDMA handset vendors have been unable to develop and build a CDMA-compatible handset capable of transmitting TTY-generated Baudot tones — at least with consistent error rate levels that are important for emergency communications.

As a carrier, Sprint PCS is dependent upon vendors, both handset and telecommunications equipment, to develop new features and capabilities, including TTY compatibility. These vendors are also subject to the requirements of Section 255 of the Communications Act,⁷ and they have the express obligation to make their equipment "compatible with peripheral devices and specialized [CPE] used by individuals with disabilities to achieve accessibility," including "TTY connectability" and "TTY signal compatibility."⁸

Sprint PCS has worked with CDMA vendors and knows they share a common commitment to develop a cost-effective solution that attempts to meet the needs and preferences of persons with hearing or speech impairments. However, until new TTY-compatible solutions

⁶ See, e.g., 47 C.F.R. § 20.12(c); *E911 Order*, 11 FCC Rcd 18676, 18693 ¶ 33 (1996)("[A] covered carrier is required to forward to PSAPs only those calls from mobile units that transmit using an air interface protocol compatible with that used by the covered carrier's system.").

⁷ 47 U.S.C. § 255(b)("A manufacturer of telecommunications equipment or customer premises equipment shall ensure that the equipment is designed, developed, and fabricated to be accessible to and usable by individuals with disabilities, if readily achievable.").

⁸ 36 C.F.R. § 1193.51(d) and (e). However, the Access Board has confirmed that Section 255's requirements are prospective only and that, as a result, handset vendors are not required to retrofit existing handsets. See Access Board, *Telecommunications Act Accessibility Guidelines*, 63 Fed. Reg. 5608, 5612 (Feb. 3, 1998). The Commission has tentatively reached the same conclusion. See *Implementation of Section 255 of the Telecommunications Act of 1996*, WT Docket No. 96-198, *Notice of Proposed Rulemaking*, FCC 98-55, at ¶ 120 (April 20, 1998)("Section 255 does not require that [an existing inaccessible] product be modified to incorporate subsequently, readily achievable access features.").

are introduced into the market, Sprint PCS, like all other CDMA-based network providers, will be unable to transmit any TTY-originated traffic over its CDMA network with error rates consistently approaching the one percent rate achieved by first-generation, analog cellular systems. Accordingly, there is "good cause" for entry of a waiver of Rule 20.18(c).⁹ Indeed, the Commission has previously recognized that carriers like Sprint PCS are dependent upon vendors and that a waiver of a rule requirement is appropriate when vendors are unable to make a capability available necessary to comply with a Commission rule.¹⁰

Sprint PCS is committed to finding a solution satisfactory to all involved. It is for this very reason that Sprint PCS has:

- ◆ Actively participated in the Wireless TTY Forum;
- ◆ Actively participated in the CDMA Development Group ("CDG"), which is investigating alternative TTY access arrangements with CDMA networks;
- ◆ Named a TTY access project manager to ensure that Sprint PCS remains abreast of all new developments;
- ◆ Purchased TTY units so it could perform its own tests;
- ◆ Helped author the 35-page TTY/CDMA test plan;¹¹ and
- ◆ Pursuant to these new procedures, tested several CDMA handsets with TTY devices, submitting the results to the public for its review.¹²

⁹ See 47 C.F.R. § 1.3. See also *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969); *Northeast Cellular v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990).

¹⁰ See, e.g., *Roosevelt County Rural Cooperative*, 13 FCC Rcd 22, 42 ¶ 30 (1997) (Waiver is appropriate because "the product needed to accomplish the upgrade to their individual networks is not readily available from switch manufacturers.").

¹¹ See *TTY Over CDMA Laboratory and Field Test Procedures*, Version 2 (Oct. 16, 1998);

¹² See *Sprint PCS, TTY Over CDMA Laboratory and Field Test Results* (Nov. 19, 1998).

Sprint PCS also stands ready to conduct additional tests once proposed solutions have been identified and prototypes have been built. And, Sprint PCS remains fully committed to continuing to participate fully in the Wireless TTY Forum (and the CDG), including the implementation of the Workplan, until a satisfactory solution is identified, tested, and available in the market.

Consumer concerns are an important factor in developing a solution for consumers, and Sprint PCS has already taken these concerns into consideration. For example, when it appeared that a voice solution may not be readily available, Sprint PCS spent considerable time examining other possible means of transporting TTY calls, including over a modified version of its data network now under construction.¹³ However, this approach would not support the voice carry-over and hearing carrier-over features or the transmission of location information that consumers deem important.¹⁴ Consequently, Sprint PCS's attention is now focused on the promising new development announced by Lucent, which should support both VCO/HCO and location information capabilities (*via* interaction with modifications to Sprint PCS's network) and which be capable of being implemented sooner than other alternatives.

At this time, Sprint PCS does not know whether all 13 items in the consumer group list will be supported by the Lucent proposal, although it appears that many (and perhaps all) of them may be supported. The list is nonetheless helpful because it provides additional benchmarks in evaluating other proposed solutions as they undoubtedly will be introduced in the near future.

¹³ See Sprint PCS Comments, Docket No. 94-102, at 4-7 (Oct. 30, 1998).

¹⁴ *Id.* at 5.

The Bureau has asked when this capability will be made available to TTY users.¹⁵

As a carrier, Sprint PCS does not know when vendors will be in a position to implement the Lucent proposal; indeed, its feasibility has not yet been confirmed. However, Sprint PCS is already in the process of contacting its handset and switch vendors about the feasibility of Lucent's promising solution. While Sprint PCS is reluctant to speak for its vendors, implementation within 12-18 months from a firm decision (whether based on industry consensus or a Commission order) *may* be readily achievable.¹⁶

III. Promising Recent Developments Make It Likely that TTY-Compatible CDMA Handsets Will be Available in the Market Reasonably Soon

The real issue facing the TTY users is not simply 911 access over digital CMRS networks, but having access to second-generation digital CMRS networks altogether. Sprint PCS is not aware of any handset in the market today that is compatible with TTYs and digital air interfaces and that consistently meets the transmission standards achieved by first-generation analog technologies.

Sprint PCS submits that the best solution would be for TTY manufacturers to modify their equipment so TTY users could have the option of connecting their TTY directly to digital CMRS networks — much like they have developed TTYs capable of direct connection to landline networks. A “direct connect” TTY handset would obviate the need for persons with hearing and speech impairments having to purchase two separate pieces of equipment (a TTY and a digital handset). Moreover, a “direct connect” TTY handset would obviate the need to

¹⁵ See *November 13 Order* at 3 ¶ 11(2).

¹⁶ The needs of TTY users will not be advanced if each carrier/vendor pursues its own, incompatible solution. What is needed is a common solution so the number of interfaces presented to the TTY user community is limited.

connect and use two devices in a time of an emergency. Although TTY manufacturers could design an efficient TTY-based digital handset,¹⁷ they have not done so, at least to date.¹⁸ It appears, then, that the onus of building a TTY-compatible digital handset will fall on CMRS handset manufacturers.

The Commission was apprised before adopting Rule 20.18(c) that TTY access through digital handsets may be problematic.¹⁹ At first it was believed that the principal problem was the handset's vocoder, which converts human voice into a digital format compatible with a particular digital air interface.²⁰ However, this past summer Lucent discovered that the major obstacle for CDMA technology is not with the vocoder as engineers had initially suspected, but rather is more closely related to the CDMA frame erasure rate ("FER") inherent to CDMA technology.²¹ CDMA networks are generally designed to operate with a FER of 1%, and Lucent discovered that conversion of Baudot analog tones to a digital format with this FER system design

¹⁷ Current TTYs convert Baudot data into Baudot-based analog tones. This digital-to-analog conversion requires digital handset vendors to re-convert these analog tones into a digital format for transmission over digital CMRS networks. In contrast, TTY vendors could build a TTY handset that simply converts Baudot data directly into the digital protocol used by various air interfaces — without having to perform the digital-to-analog-to-digital conversions required by handset solutions.

¹⁸ Regrettably, current law is written in such a way that it discourages TTY manufacturers from developing TTY-based handsets. Only manufacturers of "customer premises equipment" are subject to Section 255. See 47 U.S.C. § 255(b). The Access Board has confirmed that "direct connect" TTYs are CPE and subject to Section 255, while TTYs requiring connection to CPE for network access are "peripheral devices" not subject to Section 255. See Access Board, *Telecommunications Act Accessibility Guidelines*, 63 Fed. Reg. 5608, 5620, 5623, 5624 (Feb. 3, 1998). Consequently, TTY manufacturers can avoid the burdens of Section 255 simply by not building CPE/handset capabilities into their TTY equipment.

¹⁹ See, e.g., *E911 Order*, 11 FCC Rcd 18676, 18701 ¶ 49 (1996) ("Commenters note that CDMA vendors have been unable to pass through Baudot frequency signaling without distortion.").

²⁰ See, e.g., *E911 Reconsideration Order*, 12 FCC Rcd 22665, 22693-94 ¶ 56-57 (1997). Another major problem faced by the CMRS industry is the absence of industry standards governing the output performance of TTY devices. The telecommunications industry took the lead and developed a draft TTY standard in 1986, but this proposal was never adopted because TTY vendors were unable to agree on the proposal. See October 1998 TTY Forum Status Report, at 10 (Oct. 13, 1998); Wireless TTY Forum Workplan: TTY Access over Digital Wireless Systems, at 5-6 (Nov. 6, 1998).

²¹ See July 1998 TTY Forum Status Report at 2 (July 10, 1998).

produced a character error rate levels above those encountered with analog cellular networks.²² Sprint PCS subsequently confirmed Lucent's preliminary analysis in separate tests conducted in its laboratory.

A major breakthrough occurred last month when Lucent announced the concept of a new CDMA receiver/repeater. Simulation testing has demonstrated that with this receiver/repeater, "a TTY/TDD signal can be transmitted reliability on a CDMA channel" and that the TTY character error rate can be reduced "to less than 1%":

Aside from being effective, this [repeater] solution can be implemented over the short term because it is transparent to the CDMA network and it is completely interoperable with the existing system. Since it is an interoperable solution, new standards are not needed, allowing the industry to implement the receiver/repeater in a more timely manner than if new standards were required.²³

Basically, Lucent's proposed CDMA receiver/repeater mitigates the effects of frame erasures encountered when transmitting a "pure" Baudot tone through the vocoder by re-constructing the Baudot signal before transmitting it through the CDMA vocoder.

If, as it appears, this solution can be implemented without changing any industry standards (and assuming testing confirms the preliminary modeling results), handset vendors may soon be able to build TTY-compatible CDMA handsets that will transmit reliably TTY-based telecommunications over CDMA networks. Once these new handsets and associated

²² With CDMA technologies, the base station provides continuous instructions to the handset to control the power of the signal strength between the handset and the base station. This "closed loop power control" will increase or decrease the handset's power to maintain a 1% FER required to transmit standard voice traffic. Because Baudot-based TTYs transmit telecommunications at such a slow rate (one TTY character spans nine CDMA frames), a greater level of distortion occurs when the Baudot tones are transmitted through a standard CDMA handset vocoder.

²³ See Lucent Technologies TIA TR.45 Submission, TR45.5.1.1/98.11.03, __.

switch software become available,²⁴ persons with hearing and speech impairments will be able to use CDMA networks for all their mobile telecommunications needs, including 911 access.

IV. Sprint PCS Will Soon Deploy a New Data Network That Will Provide Exciting New Opportunities for Persons with Hearing and Speech Impairments

Sprint PCS will begin introducing next year a new mobile data/packet network that will offer exciting new opportunities for persons with hearing and speech impairments. The importance of this development is best understood with a brief review of the barriers persons with disabilities have encountered in the past and continue to encounter today.

The invention of the telephone in 1876 revolutionized society by giving most persons new means of communicating. However, this invention, ironically made by a teacher of the deaf, was of little value to the many people with hearing and speech disabilities who were unable to use the telephone network, either because they could not hear or speak.

The fundamental barrier faced by people with hearing and speech impairments — the lack of a visual alternative to voice communication — finally began to fall three decades ago. In 1964 the deaf scientist, Robert Weitbrecht, invented the first TDD (telecommunications device for the deaf) — or what is now known simply as a TTY. Mr. Weitbrecht took an old teletype machine that transmitted data using the Baudot protocol and invented a modem that converted into analog tones the Baudot data generated by a teletype. By acoustically coupling these tones to a telephone handset, a TTY user could type a message on his or her TTY keyboard and the communications would be transmitted over the analog telephone network.

²⁴ Lucent's proposed repeater algorithm is necessary to support telecommunications originating from TTY/handsets — the so-called "reverse link." Preliminary analysis suggests that CDMA carriers may also need to deploy similar algorithm software in their Mobile Switching Centers ("MCS") to support the "forward link" — that is, communications destined to a handset connected to a TTY.

This TTY system was revolutionary, because for the first time it enabled people with hearing and speech impairments to communicate using the telephone network. However, as the Commission noted 20 years ago, this system also had “inherent limitations” that rendered it “less than optimal, both in terms of an efficient utilization of the communications channel and meeting the needs of the deaf community.”²⁵ Perhaps the most serious drawback was that TTY users could communicate only with other TTY users.

This limitation was removed in part with the enactment of the Americans with Disabilities Act and the subsequent implementation of state and interstate Telecommunications Relay Services (“TRS”).²⁶ TRS systems enabled TTY users to communicate with persons without a TTY through the use of a “relay operator.” While these systems expanded the universe of persons with whom TTY users could communicate, this method of communications is hardly ideal. For example, as the Commission has observed, “the deaf may be reluctant to use [TRS] to discuss sensitive matters in the presence of strangers.”²⁷

Additional barriers were removed with the development of the personal computer and the explosive growth of the Internet. With these technologies, persons with hearing or speech impairments could now access the wealth of information on the Internet. In addition, they could now communicate in relative privacy (*via* e-mail) with the millions of persons owning a personal computer and an ordinary modem.²⁸ However, this PC/Internet development, while

²⁵ *Telecommunications Services for the Deaf*, 67 F.C.C.2d 1602, 1603 ¶ 4 (1978).

²⁶ See 47 U.S.C. § 225; Americans with Disabilities Act of 1990, Pub. L. 101-336, title IV, § 401(a), 104 Stat. 366 (July 26, 1990).

²⁷ *Access to Telecommunications Equipment and Services by the Hearing Impaired*, 2 FCC Rcd 2836, 2838 ¶ 11 (1987).

²⁸ PC owners can obtain a special modem to communicate directly to a TTY. However, these special PC/TTY modems are expensive: over \$320 for a modem that operates at 300 baud (vs. \$100-\$120 for an ordinary 56 kbps modem). See, e.g., www.ultratec.com/B31M.htm.

important, was generally available only from fixed, landline connections. While this limitation is one faced by all Americans, it has more severe consequences for persons with hearing and speech impairments who have fewer communications options when traveling.

The limitations imposed by fixed PC/Internet connections will be removed next year as Sprint PCS begins to introduce its national mobile data network. With this new network, anyone will be able to send or receive e-mail or access the Internet regardless of their location (so long as they are within Sprint PCS's service footprint). Vendors have already announced plans to develop new palmtop devices so persons can receive over these new network information such as stock prices, travel and weather data.²⁹ Sprint PCS believes the new mobility options made possible by its new data network will be particularly valuable to persons with hearing and speech impairments, as they will enjoy increased communications choices as they travel from home or work.³⁰

V. Conclusion

It is an understatement to say that the blending of 19th century technology with 21st century technologies like CDMA has been challenging. The entire industry, in cooperation with the hearing/speech impaired community, has devoted enormous resources towards this proj-

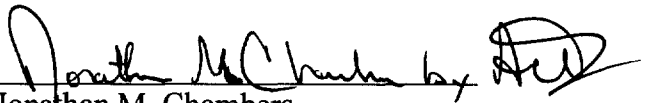
²⁹ See, e.g. *The Wall Street Journal*, "New PalmPilot Will Include Wireless Access to Internet" (Dec. 1, 1998). Qualcomm has also announced plans to introduce next year the pdQ Smartphone, an all-in-one CDMA phone and mobile palm computing organizer. See Qualcomm, "Qualcomm Announces Software Developer's Program for the pdQ Smartphone," www.qualcomm.com/news/pr981118b.html (Nov. 18, 1998).

³⁰ Sprint PCS's new mobile data network will initially operate at transmission speeds up to 14.4 kbps; and based on standards work nearing completion, it is likely that CDMA data networks will soon be capable of operating at speeds in excess of 100 kbps. Given that TTYs are designed to transmit data at only 45.5 bits per second ("bps"), see 47 C.F.R. § 64.601(3), Sprint PCS anticipates that most persons with hearing or speech impairments interested in using its new network will utilize new data handsets developed specifically for such networks so they can take full advantage of the network's features and functions.

ect. These cooperative efforts are beginning to pay dividends. Lucent Technologies in particular deserves special commendation for its new and promising innovative ideas.

Respectfully submitted,

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